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KEPLER PLANET CANDIDATES CONSISTENT WITH CORE ACCRETION

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ABSTRACT

We show that the distribution of Kepler candidate planets from Borucki et al. is consistent with the predictions of the core accretion model.

Subject headings: planets – statistics

In the distribution of Kepler candidate planets (Borucki et al. 2011), we see a clear break in the number of planets larger than about a Neptune radius, which is a generic prediction of core accretion theory (Pollack et al. 1996; Ida & Lin 2004). In Figure 1, we show cumulative distributions of the Kepler planet candidates in three bins, equally spaced in log semi-major axis to show that the break is present in each. We scale each distribution function to match the slope and zero point of a best fit line between the two dashed lines of the first bin in log semi-major axis to compare the distributions more easily. We use the interval $0.4 < \log(R_E) < 0.5$ to scale, where our lower bound corresponds to the smallest single-transit event (KOI 364.01) and our upper bound is well before the observed break. We see that all distributions show a very similar behavior with a clear break at Neptune radius, as predicted by the core accretion model.

To rescale our distributions, the best fit slopes for the three bins in semi-major axis, from smallest to largest are 530, 584, 369 stars per $\log(R_E)$, and the intercepts are -26, -88, and -91 stars.

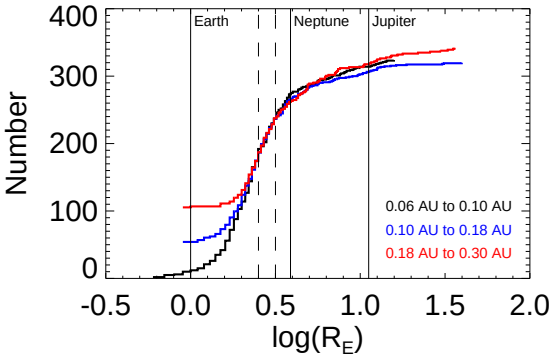

FIG. 1.— The cumulative distribution functions of planetary radius, in Earth radii, of the Kepler planet candidates. The three lines are the distribution functions in different bins equally spaced in log semi-major axis between 0.06 AU and 0.3 AU. Each distribution was normalized to the first bin by matching the slope and intercept of the best fit line between $0.4 < \log(R_E) < 0.5$ (boundaries are vertical dashed lines). The solid vertical lines, from left to right, show the radius of Earth, Neptune, and Jupiter.

REFERENCES

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